3.5   Overlapping Coverage for a Government Network Using 50 kHz Bandwidth 700 MHz Channels

In addition to antenna diversity, it is important that there be overlapping coverage from multiple sites throughout the required coverage area for a mobile data communications system. With overlapping coverage, a mobile can utilize a multi-frequency type system and travel a substantial way into the coverage area of the next site before it will be necessary to switch from one site and frequency to another site and frequency. If a site is out of service, the overlapping coverage can provide coverage over most of the area covered by that site; however, the data rate may be lower in the fringe coverage area. This provides a higher reliability of throughput for mobile data communications and it must be considered as part of any preliminary design of a new high-speed mobile data communications system.

3.6   Security Issues

High data rate commercial mobile data communications networks are fully integrated with the world wide web and as such are not as secure as government owned and controlled networks, especially if the government network is not connected to the world wide web. It is possible that the US DOJ will not permit use of some of the commercial mobile data networks to transmit criminal justice information.

3.7   Video Transmission

There is an increasing demand for video transmission over wireless connections. In general, there are three levels of video. Those three levels are:

- High quality full motion video requiring transmission of 384 kBPS.
- Motion video requiring transmission of at least 64 kBPS.
- Video in packet file form.
- Freeze frame video in which a new frame of the field of vision is captured and transmitted once each five seconds or so requiring approximately 10 kBPS.

One manufacturer indicates that raw data rates as high as 460 kBPS will be possible by 2005 in 150 kHz of bandwidth. The effective data rate for a raw rate of 460 kBPS is likely to be about 250 kBPS for short range radio transmission. That is not high enough for transmission of high quality full motion video with existing technology. Video transmission technology is evolving at a rapid rate; therefore, the MRB should continue to review advances to determine if video transmissions meeting public safety needs might be handled on a government data communications system in the future. Transmission on 150 kHz of bandwidth will require aggregating three 50 kHz bandwidth channels to a single transmission. There are only 48, 50 kHz bandwidth channels available;

therefore, use of 150 kHz at each site will permit only 16 sites before cochannel use is needed, and that may not be acceptable. There may be some high value, short duration public safety uses for video transmission such as widespread transmission of video from a surveillance camera that may be considered even though this may fully utilize the transmission channel for that period of transmission. Some video transmission needs may have a high enough value so that they should be accommodated in the system design.

There are at least two manufacturers that can provide up to 64 kBPS of effective transmission in 50 kHz of bandwidth.

3.8   Transmission Medium Agility

It is technically possible for a mobile data computer to automatically select different networks for different forms of transmission. In general; however, a different dedicated mobile radio and radio data modem is required for each network desired.

3.9   Co-channel and Adjacent Channel Considerations

In conventional 800 MHz voice FM transmission, engineering considerations suggest that adjacent radio channels generally should not be used within about 25 miles, and the same channel should generally not be used within about 50 miles. There are some exceptions to these general rules such as radio channels used only within a building.

At present, there are at least two very different modulation methods being suggested by two vendors for high data rate data communications. One uses a dual antenna FM modulation approach, and the other uses a linear amplifier radio with a very sophisticated modulation pattern construction. Both of these approaches provide for adjacent channel use, and cochannel reuse, at shorter distances than conventional FM voice transmissions. In the Minneapolis-St. Paul region (and statewide), it is possible that careful engineering may show that cochannel reuse distances may be as short as 21 to 32 miles allowing a grid layout of 7 to 16 channels with one channel at each base radio station location on approximate 7 to 8 mile centers that may then be repeated over and over again in all directions.

4.   TRAFFIC CONSIDERATIONS

4.1   Typical Current Mobile Data Communications Traffic

There is a model for determining the data communications traffic for the current kinds of uses including the advanced computer aided dispatch system uses. That model is based on the number of events during busier hour of busy month projected to the end of the useful life of any new system that is designed and

implemented. That model has proven to be accurate when it has been measured against actual traffic in 14 large mobile data communications systems.

4.2 Traffic for Currently Unmet Needs

There is no known model that can be used to determine the traffic that will be presented if currently unmet needs described in Section 1.4 are added to a mobile data communications system. In some smaller systems in which reports are transmitted to a records system, the traffic generated by those reports is about 50% of the traffic described in Section 1.3 for currently satisfied needs. It is probable that the currently unmet needs, if included in a new mobile data communications system, may double the traffic predicted through use of the model for the currently satisfied needs.

4.3 Traffic Related to Emerging Needs

Transmission of a high-resolution, full color picture or a fingerprint will require approximately 80 times as much data to be transmitted as the average message for the currently met needs described in Section 1.3. It is certain that a picture or fingerprint will not be transmitted in a significantly large number of messages, but there will be pictures with driver license inquiries and person inquiries including criminal record information. It would not be surprising to find that some of the emerging needs described in Section 1.5 might double or triple the data throughput requirements for a mobile data communications system in the systems that are currently in use. This is not a scientific determination but an approximation based on 80 times the data for a picture but making the assumption that only 1 out of 50 messages might have a picture associated with the message. It would be wise to plan any new mobile data communications system for five to ten times current data throughput in order to be fully certain the emerging needs could be satisfied.

4.4 New Unidentified Uses and Users

As the data throughput for mobile data communications systems increases it should be anticipated that more uses will be found for that system. In addition, other users who need data communications over a large geographic area, such as libraries, public health nurses and others, may find that mobile data communications is an extremely useful tool. As a result, it is recommended that any future high-speed mobile data communications system design anticipate that the traffic throughput might be 20 to 25 times higher than the traffic throughput required in order to meet the currently satisfied needs of mobile data communications.

5. PRELIMINARY DESIGN PARAMETERS FOR A GOVERNMENT HIGH DATA RATE SYSTEM USING 50 kHz BANDWIDTH CHANNELS

5.1 Alternatives

Four transmission alternatives are discussed in Section 2.0. Of those, several should not be considered for any future high-speed mobile data communications system. Those are:

- The current technology, which allows raw data transmission at 9.6 kBPS or lower speeds, is likely to be as expensive to implement as other alternatives and the effective data rate is likely to be significantly lower than 9.6 kBPS.

- CDPD is no longer a viable choice. Entities currently using CDPD may need to migrate to GPRS, or an equivalent commercial service, on a temporary basis when CDPD service is discontinued as any new public high data rate communications system is unlikely to become usable until after the demise of CDPD.

It is recommended that spread spectrum not be considered as a wide area transmission medium due to the very short range resulting in a very high number of fixed location radio sites which will be very expensive to construct and maintain. Spread spectrum sites used for downloading large files to mobile data computers is a viable use for this technology. Because current spread spectrum systems use an unlicensed portion of the spectrum, there is the potential for interference with little or no relief available from the FCC.

5.2 Government System Architecture Using New 50 kHz Bandwidth Radio Channels

A government high data rate mobile radio communications system using 50 kHz bandwidth radio channels can be designed as a system overlay above the 800 MHz trunked radio system infrastructure that is currently being constructed in the Minneapolis-St. Paul region. The radio system architecture may consist of use of the same radio sites used for the voice radio system, and use of the digital microwave system that connects those sites to two microwave network hubs. Redundant message routing equipment may be located at each of the two hubs with either message router capable of doing all of the message routing required in the network. The equipment shelters and antenna structures for the voice radio system have been designed and implemented with provision for installation of high-speed mobile data radio equipment and transmission lines and antennas. In addition, there is a full T1 span dedicated to each of the radio sites and each of those T1 spans has spare channels that may be available for the mobile data radio equipment.

It is recommended that the radio system architecture utilize a different radio frequency at each radio site so that each radio site can be transmitting and receiving different data from different mobile units at the same time. In this way, the overall capacity of the system increases to a very high throughput. The radio

frequencies should be reused at the shortest acceptable distance so that a given pool of frequencies can result in multiple frequencies in use at any given site to even further increase data throughput. It must be remembered that the key element in the design of a mobile data communications network is transmission throughput.

Any detailed design of a high-speed mobile data communications network must take into consideration the effective radio range from fixed location radio sites. As mentioned earlier in this document, the effective range decreases as the data rate increases primarily due to multi-path fading. The multi-path fading can be partially relieved through use of antenna diversity on the mobiles and on the fixed location radio equipment and through use of sophisticated forward error correction. The sites that were selected for the voice radio system were selected based on the maximum distance between sites that would be permissible to prevent half-bit errors in a simulcast voice, digital modulation radio system and not on the effective range available from the site. As a result, sites are located at closer distances than they would normally be for adequate coverage. With that in mind, it is likely that the sites will have sufficient range for high speed data communications without any significant effect from multi-path fading especially if antenna diversity and sophisticated forward error correction are utilized. Whether or not all of the sites that are deployed for the simulcast, digital modulation voice radio system are needed can best be determined when a data communications system is deployed. It is recommended that every other site be deployed first until experience shows that additional sites are required for adequate coverage.

In Section 4.4 of this document, it is estimated that 20 to 25 times more data traffic will need to be transmitted than is the current capacity. A new high-speed data communications system will be able to provide that without using a separate 50 kHz bandwidth channel at all of the sites required for the simulcast, digital modulation voice radio system. Therefore, in addition to experimentation in regard to coverage, it is recommended that only every other site be equipped as a data communications site until experience shows that more sites are required to handle the data traffic levels. In addition, only one data communications channel should be implemented per site until experience shows that more than one channel is required at some sites due to the higher data traffic demand at those sites.

5.3　Data System Plan

The key element in the data system plan is that the data system must be designed using TCP/IP protocols and compatible applications software throughout the system (See Section 3.1 in this document). This includes the software that is utilized in the mobile data computer devices in vehicles and hand held equipment as well as in the message routing and the connected computer systems. This means that the message routers must look more like Internet servers. Use of the TCP/IP protocols will greatly simplify interoperability and

communication with varied data systems at remote locations. This is an essential requirement.

The ability to intercommunicate between mobile data device users from different agencies that are transmitting data over different mediums is going to be a valuable feature that is often not available in any way today. This should be a strong requirement in the design of the data system. Use of the aforementioned TCP/IP protocols and compatible applications software will greatly simplify this task.

With channel reuse, 48, 50 kHz bandwidth radio channels may be the equivalent of 100 or more channels, each capable of transmitting as much as 70 kBPS of data. This is probably 30 to 50 times as much radio data transmission as is possible today. It is important to observe; however, that this data transmission capability is limited to that amount, and the total transmission capacity may not be expandable above that level for a long period into the future. Therefore, users must agree to keep as much static data such as maps and building floor as possible in the computer databases in the vehicles. That data can be updated frequently when the vehicle passes a location where a very high data rate, short range radio transmitter is located, or the vehicle database can be updated by connecting to a data port when the vehicle is in a home garage.

Lower priority, high data volume transmissions, such as video transmission, should be evaluated and controlled to avoid delaying or preventing transmission of many short text messages that have high priority.

Only text information for message format fields should be transmitted if reasonably practical, and the field headers should be kept in the mobile data devices and in the fixed location computer systems in order to reduce the amount of data that must be transmitted. Most information that will be transmitted will continue to be text information and the absolute minimum amount of text required to be transmitted should be included as part of the data system plan.

In order to reduce the amount of information transmitted, only the information that is needed by the recipient is transmitted. That means that any data system plan must require that only the essential information of a record be stripped from the record and reformatted before being transmitted over the mobile data network. That is another essential element of the data system plan for any new high-speed mobile data communications system design.

It is essential, again to reduce the amount of data transmitted, and therefore, information that is available in the Windows structured word-processing system should be converted to an ASCII text stream if reasonably practical.

As indicated earlier in this document, there are at least two viable technical approaches to the design of a high data rate data communications system

offered by two different vendors. Each vendor can provide relatively high data rates over a 50 kHz bandwidth radio channel. One vendor can provide much higher data rates over a 150 kHz bandwidth channel obtainable by aggregating three adjacent 50 kHz channels. The other vendor can probably provide up to three times the data throughput of a 50 kHz channel by transmitting different parts of a single data message on each of three separate 50 kHz radio channels; however, those channels may not be adjacent channels. If needs for data rates above 128 to 192 kBPS are needed in a government data communications radio system, it may be necessary to decide which technology will be used across the entire Mineapolis-St. Paul region so that a frequency plan for use of the 50 kHz channels can be developed. The frequency plan may be based on aggregating three adjacent 50 kHz channels at each base radio station location or on assigning three non-adjacent 50 kHz channels at each base radio station location. It may also be possible to arrange frequencies one way in part of the region and another way in another part of the region. This may be possible as there may be additional 50 kHz bandwidth channels in the future as indicated in Section 2.3.

5.4 User Agreements

The infrastructure for a government, 700 MHz, high-speed mobile data communications system will be expensive. The same infrastructure can be utilized by a very large number of entities at a far lower cost than the total cost if each, or if many, of those entities each develops its own infrastructure. A government owned data communications network may be more reliable than a commercial network as the government base radio locations may be more secure and will likely be equipped with UPS and backup generator power systems. Interoperability intercommunication, and region wide roaming, will be much easier to accomplish if multiple entities share the same infrastructure. Shared use of the 48, 50 kHz bandwidth channels will result in higher utilization factors per channel resulting in greater spectral efficiency. Control of the network by governments can result in data load management during times of extraordinary events resulting in less chance of system overload and inability to communicate. Government control will also provide greater protection against changes for the benefit of business decisions by others.

Use of a shared infrastructure requires that there be agreement on the part of the users of that infrastructure on many factors. Some of those factors were described in Section 5.3 under the data system issues. All of the users of the system must agree to utilize the system with the same formats and protocols in order to get maximum effectiveness.

In addition, all users of the system must agree to use compatible vehicle based and data control hardware and software. It is unknown at this time what success APCO will have with the Project 34 effort. Based on the Project 25 experience, it is likely that Project 34 will eventually publish specifications that could guide design of equipment. This does not guarantee, however, that different

manufacturer's equipment will operate successfully in the same system so that competitive bidding of equipment can occur at any time. Whether or not there are multiple sources for equipment, all users of a common infrastructure must agree to use compatible equipment. That compatible equipment must include mobile and fixed location radio equipment and mobile and fixed location radio data modems.

The mobile data system computer equipment should also include the ability to add various peripherals including such things as a driver's license magnetic strip reader and a fingerprint reader.

Specific requirements to assure interoperability, including the ability to intercommunicate by digital messaging with transient persons from a foreign network must be met.

The radio data devices must also include the ability to add GPS equipment so that this mobile data communications system may also communicate vehicle location information in a very efficient manner.

The software utilized in the mobile data computer devices must be the same or at least easily able to operate with any standard software that is specified by the majority of the users.

Software in computer aided dispatch and records management systems must be compatible with the mobile data computer software capabilities. All new computer aided dispatch and records management systems purchased by potential users of this high-speed mobile data communications system should be specified as able to readily communicate using the TCP/IP protocols in anticipation of that being the standard protocol available from the message routing equipment in the data communications system.

When the mobile computer device data communications software is specified, it should be specified in a way in which it is user friendly. Standard laptop computers are anything but user friendly in the mobile data device environment for public safety entities.

All of these issues will require a substantial amount of agreement on the part of the users. That agreement can only be achieved over an extended period of time during which representatives of the users review many issues and discuss those issues until a consensus can be achieved.

5.5 Costs

It is impossible to determine specific cost elements accurately at this time as production equipment is not available on the market. Notwithstanding that fact, it is possible to provide certain cost information for guidance purposes. That information is transmitted in this section of this document.

It is probable that there will be little, if any, site development costs as existing sites for the regional 800 MHz trunked radio system can be used.

It is probable that the base radio equipment may be at either the same approximate cost as existing FM voice radios or they may be about four times that cost, or about $50,000 per fixed radio station including installation costs. The base stations may be similar in cost to those that are utilized in the 800 MHz, digital modulation, trunked voice radio system if the data base radio stations use linear amplifiers rather than standard FM radio technology. If the voice radio system is fully deployed throughout seven metropolitan county subnetworks, it is likely that there will approximately 70 radio sites. Since some sites may have more than one channel installed, it is prudent to assume that 100 base stations that would cost somewhere between $12,500 each and $50,000 each will be the outside maximum quantity of base stations needed to implement a new high-speed mobile data communications system. The lower end of this estimated cost range is for FM stations capable of transmitting raw data rates of 128 kBPS in 50 kHz of bandwidth. The upper end of the cost range is for stations with linear amplifiers capable of transmitting raw data rates up to 460 kBPS in 150 kHz of bandwidth. It is probable that fewer than 80 base stations will be needed for an acceptable region-wide shared data communications network for at least several years.

Each site would add two channel modems to the microwave system channel banks at a cost of about $4,500 for the pair of channel modems required per radio station. Therefore, there would be approximately 80 times $4,500, or $360,000, of channel modems required for a fully deployed network.

The cost of an Internet type server for a message switch is unknown, however, for guidance purposes, it may be assumed that each of the two servers will cost $300,000 each or a total of $600,000 for the system.

A Data Network Controller (DNC) to direct and check data radio signalling is also required. For reliability, two DNCs should be included in the network. Existing DNCs cost approximately $100,000 each. It is assumed that a DNC for a regional network will be larger and more complex so a cost per DNC of $250,000 is assumed for this plan.

The cost of mobile radios and mobile data modems is unknown. On the low end of the range of likely cost at about $2,500 each are FM radios capable of data rates of 128 kBPS in 50 kHz of bandwidth. Mobile radios with linear amplifiers, capable of data rates up to 460 kBPS in 150 kHz of bandwidth might cost as much as $7,000 each. Radio data modems will likely be more expensive for the higher data rates as well. With diversity, however, it is suggested that an additional $800 per radio be assumed. In the existing systems, the total mobile

installation including a mobile radio, radio data modem and software costs are in the neighborhood of $5,000.

6. IMPLEMENTATION

6.1   Recommended Government Data Network Design

It is clear that the major technical factor in the design of a government wireless data communications network is throughput. What can be done with wireless data communications is determined by the traffic carrying capacity of the network. It is clear that the highest data traffic carrying capability per channel, and the greatest number of available channels for a government data network, are in the new 50 kHz bandwidth,128 kBPS, 700 MHz data only radio channels. For that reason, it is recommended that any new high-speed, government owned wireless data communications network be constructed utilizing those 700 MHz radio channels.

It is also strongly recommended that this network be constructed throughout based on the TCP/IP protocol. Each work position at every fixed location should have a separate IP address and every mobile data communications device should have a separate IP address. Every data related system, including all new computer aided dispatch systems, records management systems, and integrated justice systems, should also fully utilize the TCP protocol for data communications. All of these systems should also be purchased with a requirement that they be able to transmit and receive text as an ASCII stream if practical.

As the system is deployed, it is recommended that the initial Request for Proposal document state initial throughput and coverage requirements for the initial implementers and allow the vendors to propose initial system configurations that make most effective use of their technology. Once the system is installed, coverage should be evaluated to see if additional sites are required to provide a level of coverage that will be required so that data communications is available throughout a very high percentage of the geographical area covered by the initial implementers. That number of sites should also be evaluated in terms of the ability to carry the data communications traffic load that will be presented to the network. If either the coverage is inadequate or the traffic carrying capability is inadequate, then additional sites that are part of county or city subnetworks may be added as required. If further traffic carrying capability is required, more than one of the new channels may be installed at any given site, and additional sites and/or channels may be added in the future.

The 48 new 50 kHz bandwidth radio channels will not be available for licensing until the FCC approves a state plan for their use. Some government entities in the Minneapolis-St. Paul region must migrate to a new data communications system as soon as possible. It is essential that everything possible be done to

complete the plan for use of the 48, 50 kHz bandwidth channels as soon as it can be accomplished. As the regional pan is developed, consideration may also be given to increasing the number of 50 kHz bandwidth channels by aggregating 6.25 kHz channels that are available for voice. It may also be possible to provide 50 kHz bandwidth channels before the regional plan is completed by aggregating statewide assigned 6.25 kHz bandwidth channels if one or more government entities must migrate to a high data rate communications capability at an early time.

All new base computer systems, including all new computer aided dispatch systems, records management systems and integrated justice systems, should all be implemented with the TCP/IP data communications protocol.

6.2   Continuing Activities

Two-way voice communications are the most critical need of public safety operations, especially during high priority events. Data communications will never be more important than voice; however, it is possible that data communications will become the dominant form of day-to-day communications, especially for law enforcement personnel within a few years.

At this time, fall 2003, there are several large public safety entities that have data communications systems that are simply not functioning anywhere near needs, and demands are growing rapidly. Those entities must migrate to a substantially better data communications system within the next year and one-half. They must migrate with or without a regional plan for use of the new 50 kHz bandwidth channels.

There are substantial benefits available if a single regional infrastructure and frequency plan is used by all entities that elect to migrate to a high data rate communications system using the new 50 kHz channels. For that reason, it is essential that a regional plan and design be developed and adopted as quickly as possible, at least in time for entities to circulate a Request for Proposals for the first implementations by late spring of 2004. Development of that plan should begin, perhaps under the call and charter of the Metropolitan Radio Board, as soon as possible because those entities must move forward. The goal of the infrastructure plan and design, with a frequency use plan, is a long-range final build out infrastructure description that early implementers can follow and comply with as parts of the infrastructure are placed into service. This process will lead to final use of a single infrastructure, and entities that migrate in the future will have equivalent access to the 50 kHz data channels. The 700 MHz Regional Planning Committee should be a participant in the plan and design development so that the regional 700 MHz plan submitted to the FCC for approval is consistent with the 50 kHz plan and design developed for implementation. The plan and design must include the aforementioned frequency use plan, and it

should also include standards on use of TCP/IP and mobile data software as described elsewhere is this document.

A parallel activity to the plan/design development should be the development of a Request for Proposals (RFP) document that can be circulated to potential vendors for a high data rate communications system using the 50 kHz bandwidth, 700 MHz channels. Potential participants in the RFP development should be required to agree to participate in approximately 30 days after being invited so that the process is not delayed. The RFP participants may decide to circulate a Request for Information document requiring a written response followed by a presentation to answer questions. That will provide the RFP participants with important insight in regard to the requirements to be included in the RFP. The RFP development participants must stay in close contact with the regional plan and design process to assure that the RFP requirements are consistent with the regional plan when it is completed.

6.3   Specific Action Steps/Work Plan

1. During the months of October and November, 2003 circulate this Plan for comment among the Metro Area Mobile Data Users Group, individual interested agencies, the SMG and the TOC.

2. At its December, 2003 meeting the Radio Board adopt this "Plan for Adding a High-Speed Mobile Data Communications Layer to the Region-Wide Public Safety Radio Communications System-Phase One" and direct staff and the TOC proceed with implementing the Plan.

3. Establish as Radio Board Policy that purchases approved by the Radio Board of Data Layer backbone equipment, end user equipment and related services by Eligible Users, which are part of or used on the System, are covered under the exemption from Minnesota Sales Tax.

4. The Radio Board shall establish a subcommittee of members of the Technical Operations Committee and interested persons to develop a set of standards for data transmission similar to the standards established for voice transmissions. These standards should be developed with consideration of the issues discussed in Sections 5.3 and 5.4 in this document and shall be ready for approval by October 1, 2004.

5. By February 2, 2004 solicit and receive consulting engineering proposals to: (1) Prepare an RFI as outlined above for release to the vendors; (2) Prepare a needs analysis of present and future users and applications; (3) Prepare a performance based RFP for establishment of a contract for equipment and services to construct data layer infrastructure and end user equipment; (4) To work with the successful vendor and the Region 22 700 MHz Committee to

finalize a region-wide plan for use of the 50 kHz bandwidth, 700 MHz channels.

6. By February 17, 2004 solicit and receive preliminary letters of intent from those Eligible Users desiring to have a detailed design request for a Local Data Subsystem included in the Board's RFP.

7. By March 5, 2004 complete the consulting engineering services agreement, agreements with local subsystem participants and determine cost allocations for the consulting services.

8. By April 15, 2004 issue the RFI to the vendors and begin review of preliminary drafts of the RFP.

9. By June 15, 2004 issue the RFP to the vendors.

10. By August 16, 2004 receive proposals and commence evaluation.

11. By October 1, 2004 recommend:
   • Approval of draft standards for data transmission;
   • Approval of a technical plan;
   • Approval of a frequency plan;
   • Approval of a funding plan;
   • Approval of plans for additional phases;
   • Award of contract to the successful proposer to the Metropolitan Radio Board.

Attachment 11

REQUIRED CO-CHANNEL SEPARATION
700 MHz WIDEBAND DATA

SITE	ERP (watts)	ANT	ANT HGT (m)	Nearest Co-Channel User (miles)
Oakdale	70	Omni	45	42
Burschville	70	Omni	74	47
City Center	70	Omni	213	54

- **35dB protection ratio per NCC standards**
- **Relatively flat terrain**
- **Longley – Rice (50-50-50)**

Attachment 12

Minnesota 700 MHz
Wideband Channel Allotment Plan Per County
July 22, 2004

County/City	METRO	
	Supergroup A	Supergroup B
Anoka	X12,Y12*	76,77,78
Carver	X12,Y12	55,56,57
Dakota	X12,Y12	67,68,69
Hennepin	X12,Y12	31,32,33
Ramsey	X12,Y12	40,41,42
Scott	X12,Y12	61,62,63
Washington	X12,Y12	49,50,51
County/City	First Tier Collar	
	Supergroup A	Supergroup B
Chisago	X12,Y12	61,62,63
Goodhue	X12,Y12	76,77,78
Isanti	X12,Y12	55,56,57
Le Sueur	X12,Y12	49,50,51
McLeod	X12,Y12	40,41,42
Rice	X12,Y12	85,86,87
Sibley	X12,Y12	76,77,78
Sherburne	X12,Y12	67,68,69
Wright	X12,Y12	85,86,87
Pierce (WI)	X12,Y12	55,56,57
Polk (WI)	X12,Y12	67,68,69
St. Croix (WI)	X12,Y12	85,86,87

Block Designators	Channels
*X12	34,35,36,43,44,45,52,53,54,58,59,60
*Y12	64,65,66,70,71,72,79,80,81,88,89,90

	Second Tier Collar	
County/City	Supergroup A	Supergroup B
Benton	81	40,41,42
Blue Earth	88	67,68,69
Dodge	89	31,32,33
Kanabec	88	31,32,33
Meeker	79	49,50,51
Mille Lacs	90	49,50,51
Nicollet	89	31,32,33
Olmsted	88	49,50,51
Pine	89	85,86,87
Renville	90	61,62,63
Rochester	-	64,65,66
Stearns	89	61,62,63
St. Cloud	-	52,53,54
Steele	81	55,56,57
Wabasha	90	61,62,63
Waseca	90	40,41,42
Barron (WI)	90	76,77,78
Burnett (WI)	81	40,41,42
Dunn (WI)	80	31,32,33
Pepin (WI)	79	40,41,42

County	Outstate	
	Supergroup A	Supergroup B
Aitkin	34,35,36	
Becker	64,65,66	
Beltrami	43,44,45	
Big Stone	34,35,36	
Brown		85,86,87
Carlton	43,44,45	
Cass	58,59,60	
Chippewa		67,68,69
Clay		31,32,33
Clearwater	34,35,36	
Cook	43,44,45	
Cottonwood		43,44,45
Crow Wing		67,68,69
Douglas	43,44,45	
Duluth	64,65,66	
Faribault		76,77,78
Fillmore		40,41,42
Freeborn		61,62,63
Grant	79,80,81	
Houston		55,56,57
Hubbard	70,71,72	
Itasca		40,41,42
Jackson		40,41,42
Kandiyohi		31,32,33
Kittson		76,77,78
Koochiching	52,53,54	
Lac Qui Parle	64,65,66	
Lake	70,71,72	
Lake of the Woods	79,80,81	
Lincoln		55,56,57
Lyon	79,80,81	
Mahnomen	88,89,90	
Marshall		67,68,69
Martin	34,35,36	
Moorhead		76,77,78
Morrison		76,77,78
Mower		67,68,69
Murray		49,50,51
Nobles	70,71,72	
Norman		40,41,42
Otter Tail	52,53,54	
Pennington		55,56,57
Pipestone	88,89,90	
Polk		61,62,63

	Outstate	
County	Supergroup A	Supergroup B
Pope		40,41,42
Red Lake		49,50,51
Redwood	52,53,54	
Rock		31,32,33
Roseau		85,86,87
Saint Louis		79,80,81
Stevens	70,71,72	
Swift		85,86,87
Todd		55,56,57
Traverse		49,50,51
Wadena		85,86,87
Watonwan		55,56,57
Winona		85,86,87
Wilkin	58,59,60	
Yellow Medicine	58,59,60	

Attachment 13

Attachment 13

Minnesota 700 MHz Wideband Allotment Plan Per Channel
July 12, 2004

Wideband Channels	Assignment
31, 32, 33	Hennepin, Dodge, Kandiyohi, Kanabec, Nicollet, Rock, Clay, Dunn, WI.
40, 41, 42	Ramsey, Fillmore, Waseca, Jackson, McLeod, Pope, Benton, Itasca, Norman, Burnett WI, Pepin WI
49, 50, 51	Washington, Olmsted, Le Sueur, Murray, Meeker, Traverse, Mille Lacs, Red Lake
55, 56, 57	Isanti, Steele, Houston, Watonwan, Lincoln, Carver, Todd, Pennington, Pierce WI
61, 62, 63	Scott, Chisago, Wabasha, Freeborn, Renville, Stearns, Polk
67, 68, 69	Dakota, Sherburne, Mower, Blue Earth, Chippewa, Crow Wing, Marshall, Polk WI
76, 77, 78	Anoka, Sibley, Goodhue, Faribault, City of Moorhead, Kittson, Morrison, Barron WI
85, 86, 87	Wright, Rice, Winona, Swift, Pine, Brown, Wadena, Roseau, St. Croix, WI
34, 35, 36	Aitkin, La Crosse, WI, Big Stone, Martin Clearwater
43, 44, 45	Cottonwood, Douglas, Carlton, Beltrami, Cook
52, 53, 54	Redwood, City of St. Cloud, Ottertail, Koochiching
58, 59, 60	Cass, Yellow Medicine, Wilkin
64, 65, 66	City of Rochester, Lac Qui Parle, Becker, City of Duluth
70, 71, 72	Stevens, Hubbard, Lake, Nobles
79, 80, 81	Lyon, Grant, Lake of the Woods, St. Louis
88, 89, 90	Pipestone, Mahnomen

Individual Channels	Assignments
79	Meeker, Pepin, WI
80	Dunn, WI
81	Benton, Steele, Burnett, WI
88	Kanabec, Blue Earth, Olmsted
89	Pine, Stearns, Nicollet, Dodge
90	Mille Lacs, Renville, Waseca, Wabasha, Barron, WI

Attachment 14

700 MHz Wideband Allotment Plan
Assignment Separation
July 15, 2004

Channel Group	Allotments	Separation (border to border) (miles)
1	Hennepin, Dodge	43
1	Hennepin, Kandiyohi	47
1	Hennepin, Kanabec	33
1	Hennepin, Nicollet	32
1	Hennepin, Dunn, WI	51
1	Dodge, Dunn, WI	43
1	Kandiyohi, Kanabec	64
1	Kandiyohi, Nicollet	32
2	Ramsey, Waseca	50
2	Ramsey, McLeod	40
2	Ramsey, Benton	41
2	Ramsey, Burnett, WI	50
2	Ramsey, Pepin, WI	42
2	Fillmore, Waseca	47
2	Fillmore, Pepin, WI	38
2	Waseca, McLeod	38
2	Waseca, Pepin, WI	60
2	Jackson, McLeod	57
2	McLeod, Benton	40
2	Pope, Benton	45
2	Benton, Burnett, WI	43
3	Washington, Olmsted	40
3	Washington, Le Sueur	31
3	Washington, Meeker	61
3	Washington, Mill Lacs	31
3	Olmsted, Le Sueur	42
3	Le Sueur, Meeker	37
3	Murray, Meeker	61
4	Isanti, Carver	33
4	Isanti, Todd	57
4	Isanti, Pierce, WI	41
4	Steele, Houston	66
4	Steele, Watonwan	47
4	Steele, Carver	36
4	Steele, Pierce, WI	38
4	Huston, Pierce, WI	55
Channel	Allotments	Separation (border to border)

Group		(miles)
4	Watonwan, Lincoln	62
4	Watonwan, Carver	47
4	Carver, Pierce, WI	38
5	Scott, Chisago	40
5	Scott, Wabasha	40
5	Scott, Freeborn	47
5	Scott, Renville	30
5	Scott, Stearns	47
5	Chisago, Wabasha	61
5	Chisago, Stearns	49
5	Wabasha, Freeborn	36
5	Freeborn, Renville	64
5	Renville, Stearns	27
6	Dakota, Sherburne	31
6	Dakota, Mower	43
6	Dakota, Blue Earth	31
6	Dakota, Polk, WI	25
6	Sherburne, Crow Wing	42
6	Sherburne, Polk, WI	43
6	Mower, Blue Earth	38
6	Mower, Chippewa	132
6	Blue Earth, Chippewa	66
6	Chippewa, Crow Wing	85
6	Crow Wing, Polk, WI	57
7	Anoka, Sibley	35
7	Anoka, Goodhue	33
7	Anoka, Morrison	30
7	Anoka, Barron, WI	43
7	Sibley, Goodhue	38
7	Sibley, Faribault	43
7	Goodhue, Faribault	39
7	Goodhue, Barron, WI	47
8	Wright, Rice	30
8	Wright, Swift	50
8	Wright, Brown	44
8	Wright, St. Croix, WI	38
8	Wright, Pine	38
8	Winona, St. Croix, WI	49
8	Swift, Brown	52
8	Swift, Wadena	68
8	Pine, St. Croix, WI	38